

Conference Abstract

Towards an Ontology of Comparative Biogeography: New insights into the semantics of biodiversity conservation

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Abstract

Climate change, habitat destruction, and myriad other ecological stressors will impact us all and have already contributed to what is being labeled the sixth wave of extinction (Ceballos et al. 2015, Régnier et al. 2015). As a countering force, conservation biology strives to identify those areas of the planet most worthy of protecting due to their unique natural value (Dudley and Stolton 2008). Despite their value, criticisms (Camillo and Peter 2011) have been leveled at 1) the social cost of maintaining protected status (Lele et al. 2010) and 2) instances of continued biodiversity decline despite protection regimes (Craigie et al. 2010, Dudley et al. 2014). At present, the selection and delimitation of protected areas is an intuitive and often subjective process, leading to ambiguities in the semantics behind and across their definitions.

Thus, we propose that the application of ontological techniques to the ambiguities in protected area semantics is a timely contribution to conservation informatics. We hold that coherent semantic representation of the biogeographic areas which overlap protected areas (often designated empirically) will provide more efficient and standardized informatics, supporting research and decision-making processes. Our approach draws from comparative biogeography, which seeks to classify biogeographic areas based on

their natural properties in a process known as bioregionalisation. In particular, we convert a cladogram of biogeographic areas (similar to cladogram of taxa) into a series of ontological classes, each corresponding to a monophyletic clade of areas. In this model, areas of endemism are treated as formal objects related by hierarchical relationships and constrained by the monophyly condition (Ung 2018). This approach unifies a model-theoretic view of endemism with the semantic web and therefore, offering new possibilities to communicate the biogeographic units conservation.

We use semantic web standards (RDF and OWL) expressed through interoperable ["Open Biological and Biomedical Ontology \(OBO\) Foundry"](#) and Library resources to model areas of endemism as evolutionary entities for comparative biogeography. This aligns with current efforts in the OBO Foundry to extend their semantic coverage to the domains of Earth and ecosystem science. Due to our work's heavy reliance on environmental semantics, we base our work on the [Environment Ontology \(ENVO\)](#), extending it with often confounded biogeographic entities including biogeographic areas, such as areas of endemism and endemic areas, as well as their relationships. Hence, we seek to provide a rigorous and simple framework that improves biogeographic analyses and interoperability between systems.

Keywords

conservation, comparative biogeography, ontology, semantics

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